

SFT-Nex10 SCF Pump

Constant Pressure-Piston Pump



Operator's Manual

Provisional User Information Manual

Rev 12-10-2019

WARNING: This pump is rated for use with carbon dioxide only. This pump is not intended for use with flammable materials.

SAFETY SYMBOLS



EARTH GROUND



CAUTION - REFER TO MANUAL



CAUTION HIGH VOLTAGE

INTRODUCTION

This operator's manual contains information needed to install, operate, and perform user maintenance on the Nex10 SCF Constant Pressure Pump Package.

The SFT Nex10 is a robust, high capacity carbon dioxide pump designed to boost the delivery pressure of the liquified gas up to 10,000 psi (68.9 MPa). It may be used to deliver liquid CO₂ to new and existing SFE equipment including SFT's model 110, 110XW, 120, and 120XW SF extractors. The pump may be placed under an SFT-110 or 120 SFE, saving valuable lab bench space.

It may be used to inject high pressure CO₂ into reaction chambers for supercritical fluid reaction chemistry (SFR) and any other application requiring high pressure CO₂.

It is ideal for use with SFT's HPR Series™ high pressure chemical reactors. The Nex10's high performance, pneumatically driven piston pump rapidly compresses liquid CO₂ from tank pressure (750-900 psi) up to the pressures required for SFE, SFR, and other high-pressure applications. The pump operates in a constant pressure mode. The flow rate automatically adjusts to maintain the desired pressure

The Nex10 has a stainless-steel fluid path. The CO₂ is cooled by an internal thermoelectric cooling module, ensuring efficient pumping. Cooling jackets and baths are not required.

Description of the Pump

The Nex10 SCF Pump is a **Constant Pressure** pump and designed to be a reliable component wherever a constant pressure must be maintained. Pressure can be set in increments from ~700psi (CO₂ Tank Pressure) to 10,000 psi.

Pump Features

- Maintains a constant user selectable set pressure, Reliable, pneumatic pump
- Stainless Steel pump head and fluid path
- RS-232 interface

Standard Configuration

- **Flow Rate:** Up to 100 mls/min.
- **Pressure:** 700 to 10,000 psi (68.9 MPa)
- **Dimensions:** 6.25" high x 17.55" wide x 15" deep, (15 x 45 x 137 cm)
- **Weight:** 45 Lbs. (20.4 Kg)

Utility Requirements

- **Power Requirements:** One (1) 90-240VAC, single phase, 50/60. All units have a power entry module that utilizes a C14 connection.

Required Prior to Installation of the Nex10 SCF Pump

Power Requirements: The Nex10 SCF Pump requires one (1) 90-240VAC, single phase, 50/60 Hz., 5 amps supply with ground. Units sold in North America will be supplied with a NEMA 5-15 style plug. All other units will be determined on a case by case basis. All units will have a power entry module that utilizes a C14 connection (all cables will need a mating C13 end). The SFT-120 SFE requires (1) 220 VAC, 50-60Hz 15 AMPS

Pumping System:

The SFT Nex10 is a robust, high capacity carbon dioxide pump designed to boost the delivery pressure of the liquified gas up to 10,000 psi (68.9 MPa). It may be used to deliver liquid CO₂ to new and existing SFE equipment including SFT's model 110,

110XW, 120, and 120XW SF extractors. The pump may be placed under an SFT-110 or 120 SFE, saving valuable lab bench space.

It may be used to inject high pressure CO₂ into reaction chambers for supercritical fluid reaction chemistry (SFR) and any other application requiring high pressure CO₂. It is ideal for use with SFT's HPR Series™ high pressure chemical reactors.

Carbon Dioxide Tanks: Beverage Grade CO₂ tank with a dip tube (so that liquid CO₂ is drawn from the bottom of the tank). Tank pressure should be 750-900 psi at Room temperature. Do not use a cryogenic or Dewar tank.

Carbon Dioxide Tank Connection: The connection from the CO₂ tank to the Nex10 SCF Pump unit is made using the supplied CGA320 connection with shutoff valve and ¼" braided hose. The Inlet to the Nex10 Pump is an ¼" Swagelok/A-Lok type fitting. The outlet from the Nex10 Pump is an 1/8" Swagelok/A-Lok type fitting. The length of tubing between the CO₂ cylinder and the Nex10 SCF CO₂ Pump must not exceed ~4 feet (1.2 meters). Further, a CO₂ Tank Heater is also supplied to increase the delivery pressure of the liquid CO₂ to the system. Do not use a gas regulator.

Compressed Air Requirements: House Air delivering 3 SCFM and 95 psi is required to achieve 10,000 psi in your main pressure vessel. If all your work will be done at a lower pressure, a lower pressure air supply is acceptable. For example, to operate at 4000 psi, you will only need 40 psi house air. Air Consumption is proportional to pump speed.

Recommended Compressor Specifications for those without house air: HP Rating 1.0 HP, Air Delivery 3 SCFM, Maximum Pressure > 125 PSI, Tank Capacity 8 Gallons. Model: Campbell Hausfeld 8 Gallon Portable Quiet Air Compressor (DC080500) or equivalent

The Air Connection is ¼" FNPT on the Inlet to the Air Filter mounted on Unit

Bench: The Nex10 SCF CO₂ Pump is typically placed on a sturdy bench.

If you have questions, please contact us at +1 (302) 738-3420, or by e-mail:

Unpacking and Inspection

Prior to opening the shipping container, inspect it for damage or evidence of mishandling. If it has been damaged or mishandled, notify the carrier before opening the container. Once the container is opened, inspect the contents for damage. Any damage should be reported to the carrier immediately. Save the shipping container. Check the contents against the packing list.

Location/Environment

The preferred environment for the pump is normal laboratory conditions. The area should be clean and have a stable temperature and humidity. The specific temperature and humidity conditions are 10 to 30 °C and 20% to 90% relative humidity. The instrument should be located on a stable flat surface with surrounding space for ventilation and the necessary electrical and fluid connections.

Electrical Connections

The Nex10 pump can accept a wide range of input power, including 90-240VAC, 50/60Hz., 5 amps supply. Position the Nex10 Pump so that there is at least a four-inch clearance on all sides of the pump to permit proper ventilation. plug the pump into a properly grounded electrical outlet using the power cord supplied with the pump.

Installation of the Nex10 SCF Pump

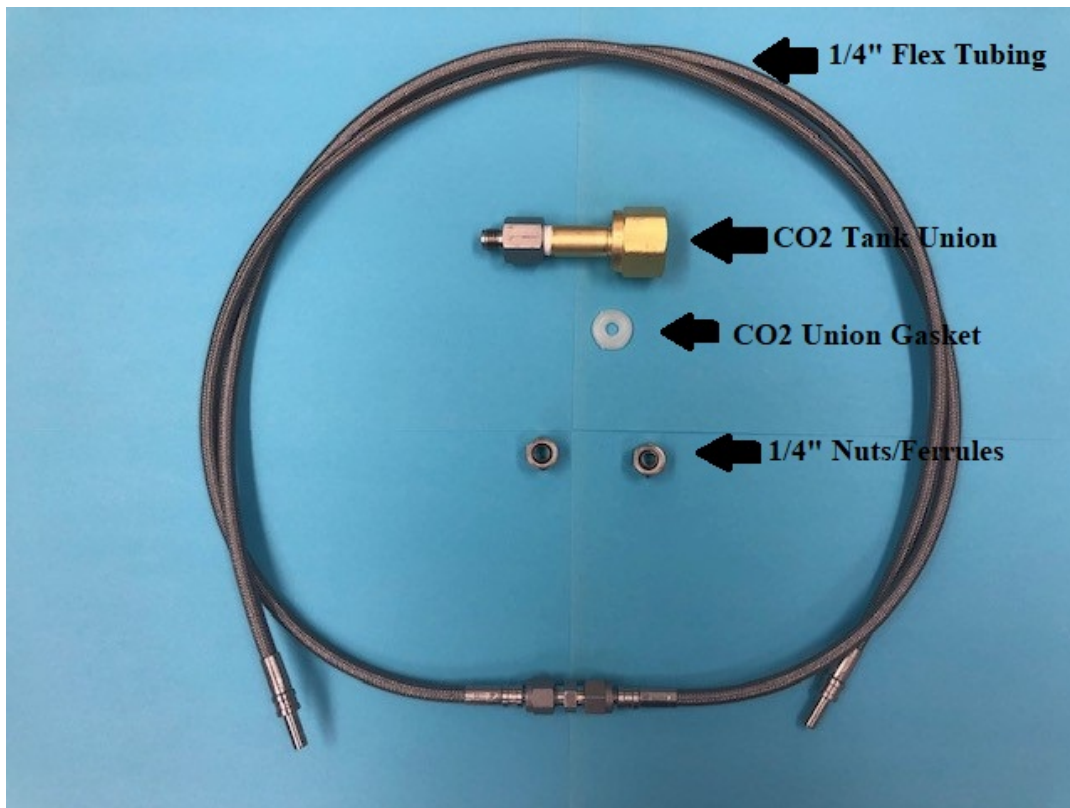
After the Nex10 SCF Pump has been unpacked and placed on an appropriate sturdy lab bench, it is time to connect: the Liquid CO₂ tank to the Nex10 SCF Pump, and the Nex10 SCF Pump to the SFT-120/120XW SFE Oven enclosure.

To connect the CO₂ tank to inlet of the Nex10 pump locate the 1/4" SS Flex tubing and Swagelok 1/4" Nut/Ferrule (clearly labeled in the parts box). Place the white washer into

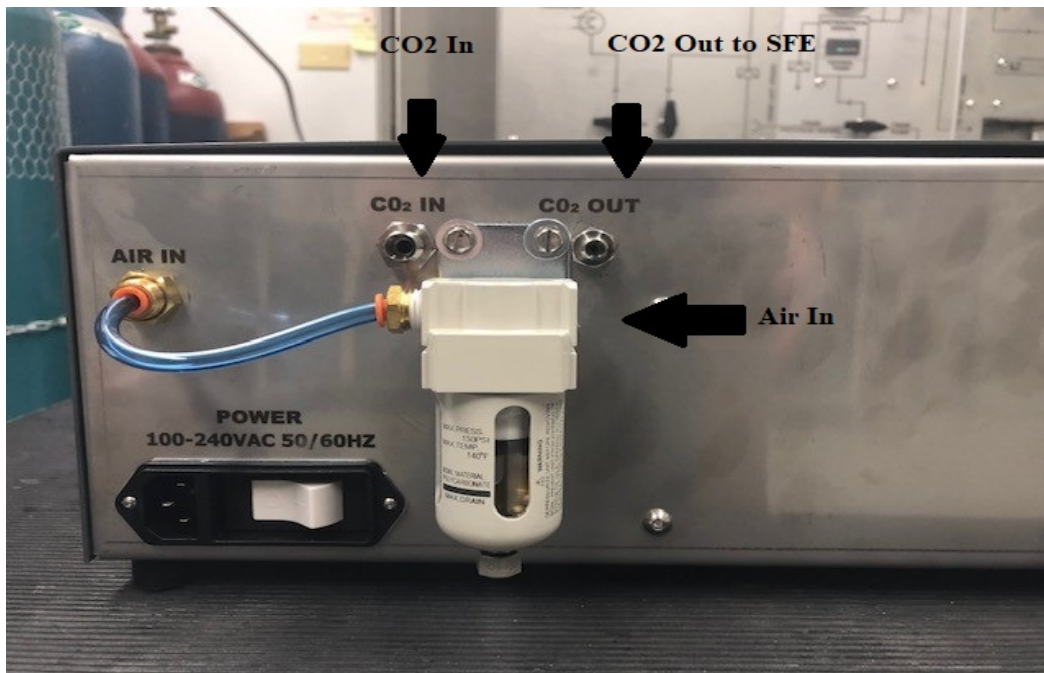
the tank reducing union. Hand-tighten the gold fitting to the CO₂ tank, then finish tightening with a 1-1/8" wrench. Place the 1/4" Swagelok Nut/Ferrule onto the end of the flex tubing and connection to the CO₂ inlet Fitting on the Nex10 Pump.



Connection of the Tank Reducing Union. Make sure to install the White Teflon gasket

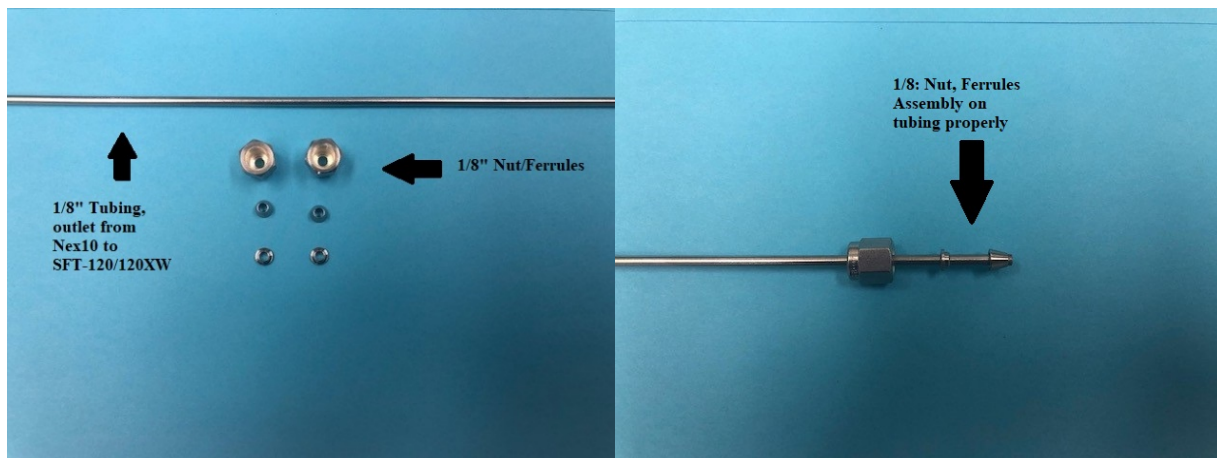


Tubing Connection from CO₂ Tank to Nex10 Pump Package



Rear of Nex10 Pump Package, note CO₂ Inlet/Outlet and Air Supply Inlet

To connect the CO₂ from the Nex10 Pump to the SFT-120/120XW oven assembly (or other equipment), locate the 1/8" tubing, (2) 1/8" Swagelok Nut/Ferrules for the outlet of the Nex10 Pump and inlet into the SFT-120/120XW (clearly labeled in the parts box).



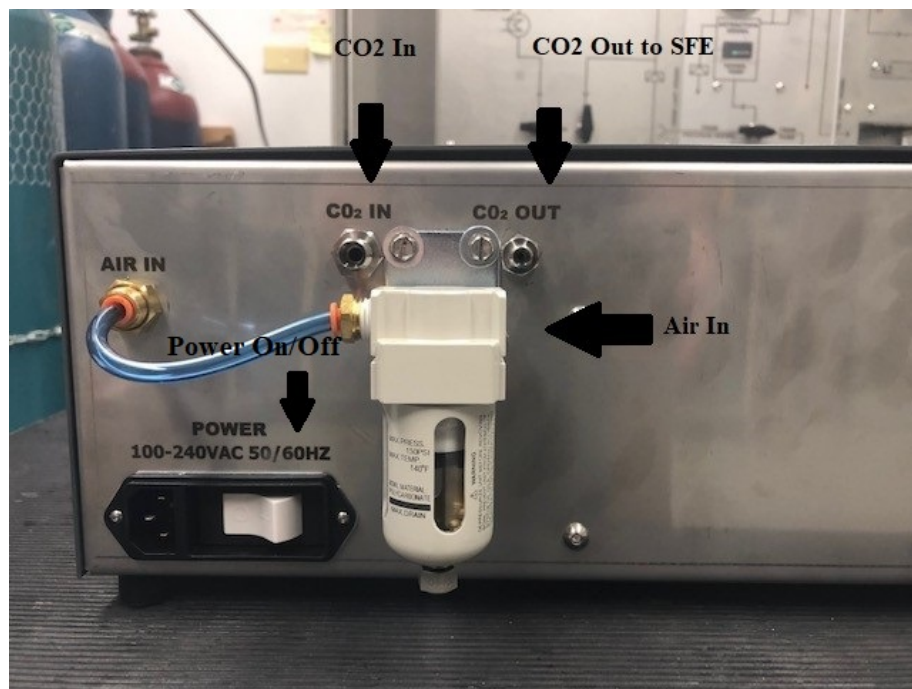
Connection from Nex10 to SFT-120/120XW

Place the end of the 1/8" tubing and nut/ferrule on the OUTLET of the Nex10. Hand-tighten the fitting into the outlet port. The 1/8" tubing, ferrule, and nut should easily glide into the outlet port. Finish tightening with a small adjustable wrench to secure the 1/8" tubing connecting on the outlet of the Nex10 Pump. Repeat the process for the

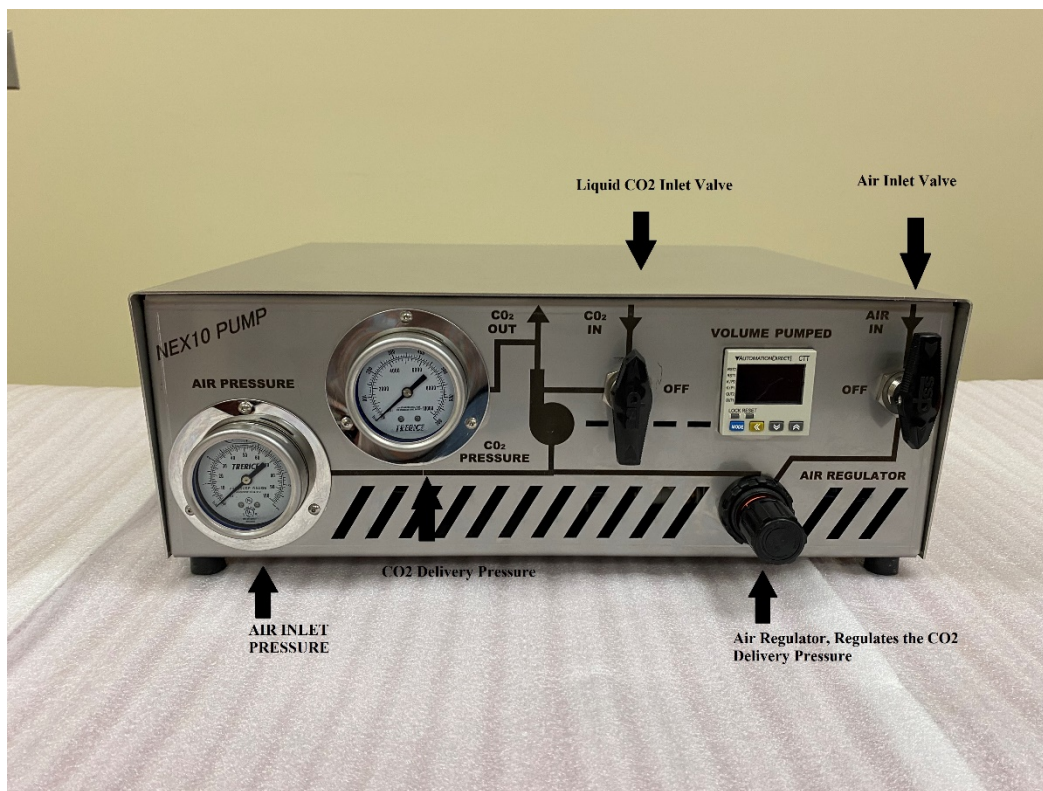
connection to the SFT-120/120XW or other equipment you desire to pressurize with Liquid CO₂.

Theory of Operation of the Nex10 SCF Pump

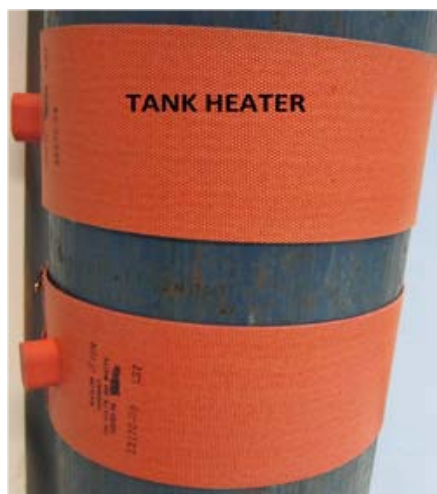
The main power switch is located at the rear of the unit. When this switch is in the ON position, power will be supplied to the rear fan, Peltier Cooling Assembly, and the front panel Flow Rate Counter display, the motor.



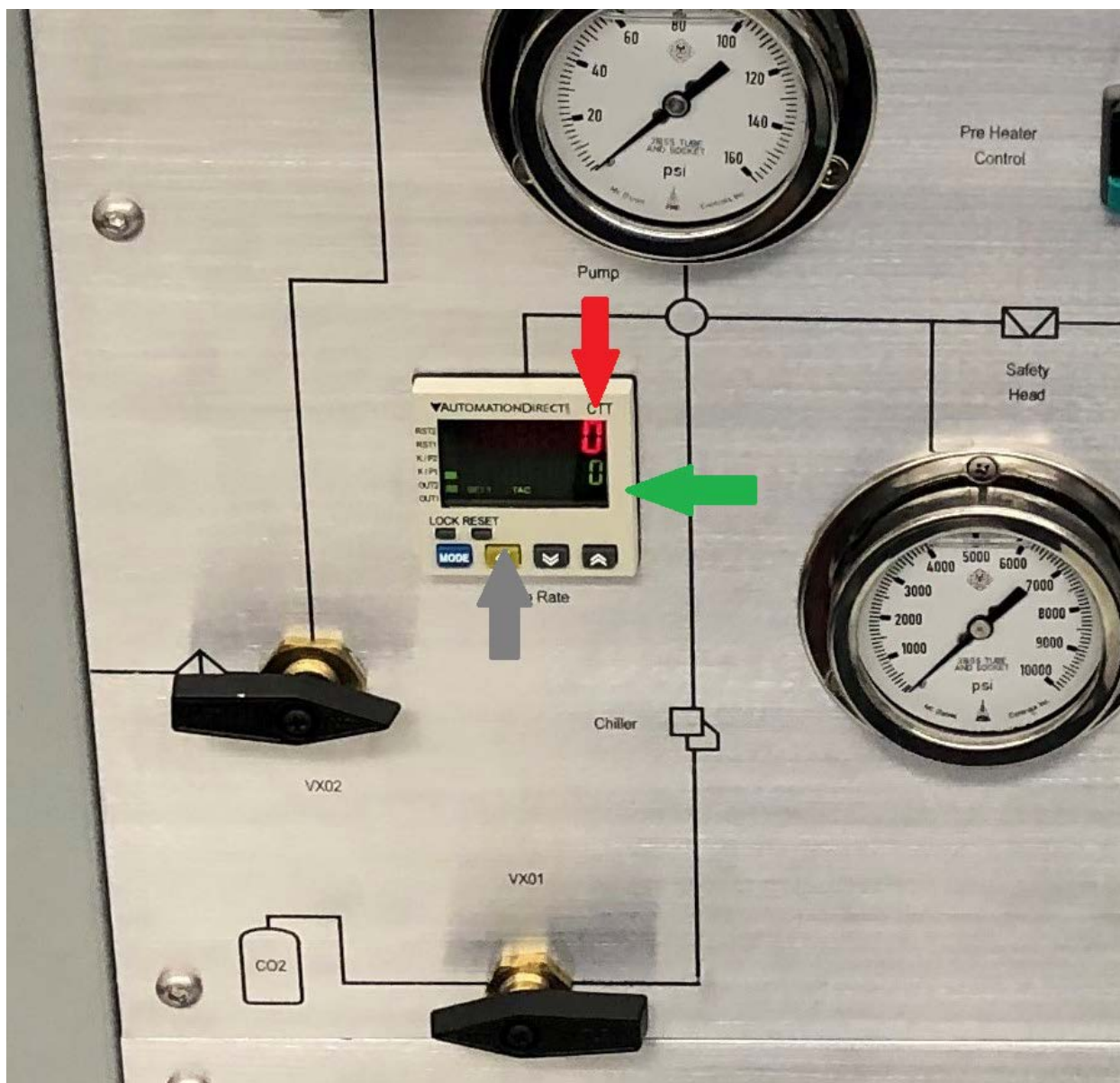
The Peltier cooler built into the pump head/heat exchanger combination requires a 20-minute minimum pre-run to lower the pump head temperature to an acceptable level for pumping liquid CO₂. This operation should be carried out with CO₂ Tank pressure (700-850psi) with the CO₂ Inlet valve in the on position bringing CO₂ into the pump



NOTE: The CO₂ tank should be room temperature (20-22°C). If the tank is cold to the touch or you are operating in a cold environment, the delivery pressure of CO₂ to Nex10 **SCF** CO₂ Pump will not be high enough. The tank will need to be heated to room temperature; A Tank heater is supplied with your startup kit. Additional heaters can be bought from SFT (P/N: 040250B4, 110VAC-50/60Hz OR 040250D1 220VAC 50/60Hz).



Use of the Flow Counter – Actual SCF CO₂ flow through processing vessel(s)



Flow Counter: Timer (**Red**), mls/min Counter (**Green**), and Reset Button (**Grey**) just below Readout)

Theory of Operation: The Flow Counter on the front panel of the Nex10 SCF Pumping Unit counts the pump strokes delivering the SCF CO₂ to your processing vessel for extraction of your raw materials. Each pump stroke delivers ~0.4 mls CO₂ Liquid/stroke (or count), which would equate to ~30 pump strokes per minute to obtain the flow rate of 15mls/min of SCF CO₂. which is a typical flow rate for 100ml vessel volumes and below found in the SFT-120/120XW Units

How to Use the Flow Counter:

There are two steps in an “extraction”, first the initial flow and pressurization of your sample in the processing vessel with CO₂ and then the actual flow through the BPR to extract and collect your extracted materials.

Step One: The flow rate during the pressurization of Sample Vessel during initial startup of SCF CO₂ Flow is not an important detail. Once you start the flow of Air to the pump and CO₂ in the system, your pump will automatically actuate to the “Set pressure” that you have dialed in using the air regulator. Initially you will have pumping of SCF CO₂ to bring the sample vessel up to the operation pressure. This information from an extraction perspective is not relevant. Once you are at operation pressure, you will then open the BPR allowing flow through the system into the collection assembly. This is where Flow Rate becomes relevant.

Once your system has been allowed to equilibrate at your set pressure and temperature, reset the Flow Counter using the **Grey Button** on the Readout. You are now ready to open the static/dynamic valve on the processing vessel pictured below and begin opening the BPR. You open the BPR unit you achieve 200mls/min,

***As an Example: You would adjust the BPR to obtain ~4mls of flow in 15 seconds, ~8mls flow in 30 seconds and so on. In this way you quickly get the pump flow up to 15mls SCF CO₂/minute

Now, you are ready to apply SCF CO₂ pressure to the Nex10 SCF Pump. You have already opened the CO₂ Tank Valve bringing CO₂ liquid into the Nex10 Pump as parts of the cooling startup. The pressure gauge for the Air supply should read the Air pressure you are supplying to the unit (up to 110 psi to operate up to 10,000 psi as an example). Open the Air inlet valve by rotating 90 degrees to open position. You want to ensure the sample vessel inlet valve (Photo below) open and the sample vessel outlet valve in closed on your SFT-120/120XW or other equipment. This allows the vessel and sample contained within to pressurize to CO₂ Tank Pressure ~700-850psi. You should note this CO₂ pressure increase on the pressure gauge for the sample vessel. At this stage you would like to the PID Temperature Controllers to be set at your operating parameters and allow the unit to reach an equilibrium of temperature over the

course of 30 minutes. Once the unit has idled at operation temperatures for 30 minutes you are now ready to apply higher pressure to the sample material and begin extraction using the NEX10 SCF Pump. This idle period is just on the initial startup of the your unit. Once you are equilibrium you can go from sample to sample without idle period

You are now ready to increase the CO₂ Pressure applied to the unit. The Nex10 SCF pumping package is engaged by **pulling** the Air Regulator Dial on the front of the unit (see pictured above) towards you and then rotating the valve in a clockwise fashion to increase Air flow to the Nex10 SCF CO₂ Pump Package. The user can actuate the desired pressure by turning the dial clockwise to increase the pressure and counterclockwise to decrease the pressure.

NOTE: The Nex10 pump package delivers liquid carbon dioxide to the vessel in a ratio of ~115 psi for every 1 psi of house air delivered to the pump. For example, rotating the air regulator clockwise to deliver 40 psi of house air would cause the pump to deliver ~4600 psi of carbon dioxide pressure to the systems 1000ml extraction vessel. The Pump will actuate to maintain the Set-pressure you desire up to 100mls of CO₂ liquid/minute

Once you have brought your system to operational parameters of pressure you desire and you open the BPR, the Nex10 SCF Pump will actuate as up to 100mls/min to maintain tis set pressure of operation.

Note: if the Nex10 SCF Pump does not maintain you set pressure, lower the outlet flow of your BPR OR ensure you have a full tank of Liquid CO₂.